NorBE Assessment: Proposed Community–Titled Subdivision of Lot 3 DP 846470, 48 Jervis Bay Road, Falls Creek.

Prepared by: Mark Passfield

SEEC Reference 18000351-WCMS-0C

29th August 2019

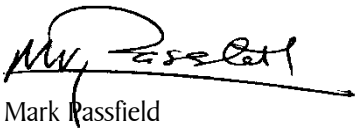
Strategic Environmental & Engineering Consulting

Strategic Environmental and Engineering Consulting

PO Box 1098, Bowral NSW 2576
phone: (02) 4862 1633 • fax: (02) 4862 3088 • email: reception@seec.com.au

Document Certification

This report has been developed based on agreed requirements as understood by SEEC at the time of investigation. It applies only to a specific task on the nominated lands. Other interpretations should not be made, including changes in scale or application to other projects.
Any recommendations contained in this report are based on an honest appraisal of the opportunities and constraints that existed at the site at the time of investigation, subject to the limited scope and resources available. Within the confines of the above statements and to the best of my knowledge, this report does not contain any incomplete or misleading information.



Mark Passfield
SEEC

29th August 2019

Copyright

Document Table

Issue Number	By	Reviewed by	Date
0ADRAFT	MP		6th May 2019
0BDRAFT	MP	JA	15th August 2019
0CDRAFT	MP	JA	29th August 2019

TABLE OF CONTENTS

Table of Figures

1 INTRODUCTION

SEEC have been commissioned by Cafebe Pty Ltd, owners of Lot 3 DP 846470 (Figure 1) to prepare this Neutral or Beneficial (NorBE) Assessment. It is required to accompany an application to subdivide part of the property that is zoned to RU5 (large lot residential) into a 15-lot community titled subdivision.

This assessment includes:

(i) An investigation into the existing water cycle;

(ii) An assessment of how the proposed development might affect the management of the water cycle;

(iii) A conceptual plan for managing the water cycle to achieve a neutral or beneficial effect (NorBE) on the quality of water leaving the site.

SEEC staff inspected the site on 3rd May 2019. Weather on that day was mild and dry.

Figure 1 – Property location (shaded yellow). © Google Earth

2 PROJECT DESCRIPTION

It is proposed to subdivide part of Lot 3 DP 846470 (Figure 1) which is zoned RU5 (large lot residential) into 15 new large-lot, community-titled, residential lots. The remainder of Lot 3 would remain zoned E2 and become community property.

A conceptual subdivision plan has been prepared by Leslie & Thompson surveyors and is shown in **Figure 2**. The subdivision would be community-titled and all the residential lots would require onsite wastewater management and rainwater tanks to supply potable water.

A road network would provide access to all residential lots. It would have a 6 m wide sealed pavement within a 20 m wide corridor and it would have a total length of about 1,080 m. The road would drain to grassed table drains (swales) in keeping with the area's rural nature. Although not part of this application, it is assumed each new lot would be developed with a typical residential dwelling.

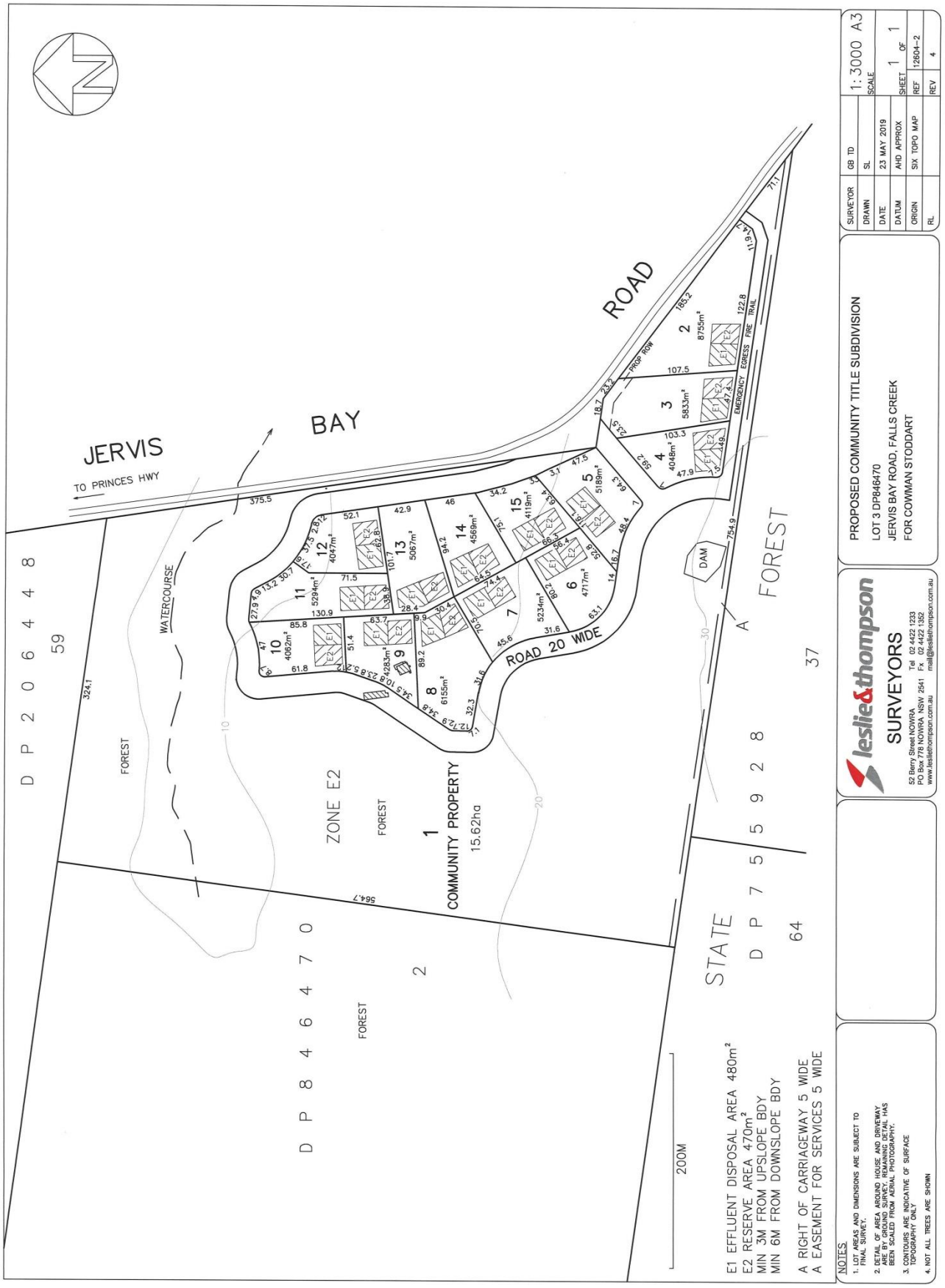


Figure 2 - Conceptual Subdivision

3 THE SITE

3.1 General Conditions

Lot 3 is a large (15.62ha) property. It is partly zoned E2 (environmental) and partly zoned RU5 (large lot residential). The RU5 lands are in the east of the property, adjacent to Jervis Bay Road. The east of the property is mainly covered with pasture grass but has some scattered native trees (Figure 2). The west of the property is covered with denser native woodland.

Figure 3 – Typical conditions on the RU5-zoned land © Google Earth

3.2 Topography and Drainage

Total relief (south to north) is about 20 m. Most of the site grades gently at about 5 percent north, towards a first-order watercourse. The watercourse drains into Currambene Creek and, ultimately, into Jervis Bay Marine Park. The southern-most part of the site drains south, ultimately to a culvert under Jervis Bay Road.

3.3 Climate

The area has a warm temperate climate with summer-dominated rainfall. Nearby Nowra has a mean annual rainfall of 1,133 mm and has a mean 127.7 wet days a year. Pan evaporation is relatively high; approximately 1,671 mm/year[1]. Potential evapotranspiration (PET) is about 1,275mm (estimated from BOM mapping).

[1] All measured at Nowra RAN station number 68076

3.4 Soils

The site is not mapped on soil landscape maps but, based on the nearby mapping available on *eSpade* and the site inspection it appears to be on the Nowra Soil Landscape. This is a residual soil landscape derived on the Nowra Sandstone. It generally consists of sandy loam to clayey sand topsoil and mottled light clay subsoil. Soils can be sodic and strongly acidic and have low water-holding capacity. Erodibility of the topsoil is low but is high for the subsoil, although this is somewhat mitigated by the low slope gradient. The soil loss class is low to moderate.

4 Land Surface Changes

4.1 Subdivision Stage

4.1.1 Introduction

For the purpose of stormwater modelling (Section 6) only that part of the property that would be developed (part of the RU5 lands) is considered; the remainder of the RU5 land and the E2 lands will remain as-is and become community land. On the RU5 lands 19.229 ha of land will become:

- 9.3ha of large-lot residential properties; and
- 2.16ha of road easement with a 20m width, 6m wide pavement (30% effective impervious).

There would also be an emergency fire trail in the far south but it is not expected to be paved and so would remain essentially unchanged from existing.

4.2 Dwelling Stage (Future DAs)

Once the lots are developed there would be a slight increase in impervious surfaces (roofs, paving and driveways) on each lot. However, as the lots are large it would be permissible to manage stormwater in absorption trenches and so the connectivity of these impervious surfaces to the stormwater drainage system would be minimal. SCA (2012) recommends the *effective* imperviousness[2] of these lots be taken as 5% for modelling purposes (Section 6).

[2] i.e. the percentage of impervious surfaces that would be directly connected to the stormwater drainage system

5 Proposed Water Quality Measures

5.1.1 Roadside Swales

The road will drain to grassed-line swales on either side. They will have the following conceptual dimensions:

- Base width = 1m
- Top width = 5m
- Side slopes 1V:4H

The swales will effectively encircle most of the development so runoff from most of the lots would also be captured by them.

5.1.2 Bioretention Basin

The swales will deliver stormwater to a single bioretention basin located in the far north. It will have the following conceptual properties:

- Surface (ponded) area = 750m^2
- High flow by-pass = 0.15m^3/s
- Filter area = 500m^2
- TN content of filter media <400mg/kg
- Phosphorous content of filter media = <40mg/kg
- Gravel-mulch surface = 50mm
- Ponding depth = 500mm
- Filter thickness = 400mm
- Transition layer thickness = 100mm
- Subsurface drainage layer = 150 mm
- Planted with moisture-tolerant species such as *Carex* and *Juncus* at eight plants per m^2.

5.1.3 Maintenance

The water quality measures would be maintained by the body corporate that would enter into a contract with an appropriately-qualified contractor. The bioretention basin would have a defined life and would require replacement (or at least re-generation) every 15-20 years or so. Such work would also be the responsibility of the body corporate.

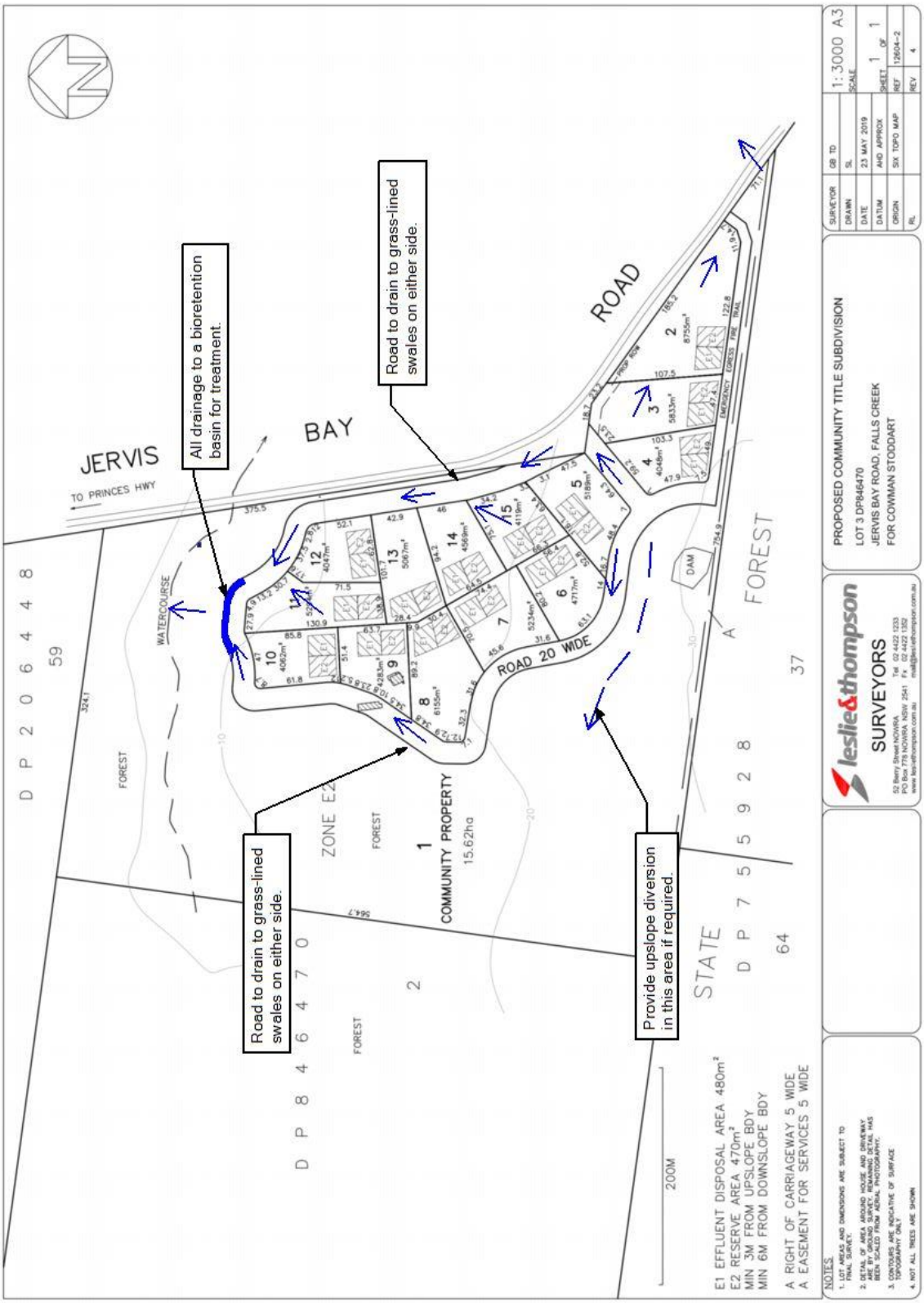


Figure 4 - Proposed Water Quality Measures (schematic)

6 Stormwater Quality Modelling

6.1 Introduction

The estimated pre and post development sediment and pollutant loads are modelled using MUSIC (Model for Urban Stormwater Improvement Conceptualisation), developed by eWater. The model is appropriately calibrated as in **Tables 2 and 3** and quantifies:

- The levels of the principal pollutants before and after development; and
- Changes in export levels because the development is there.

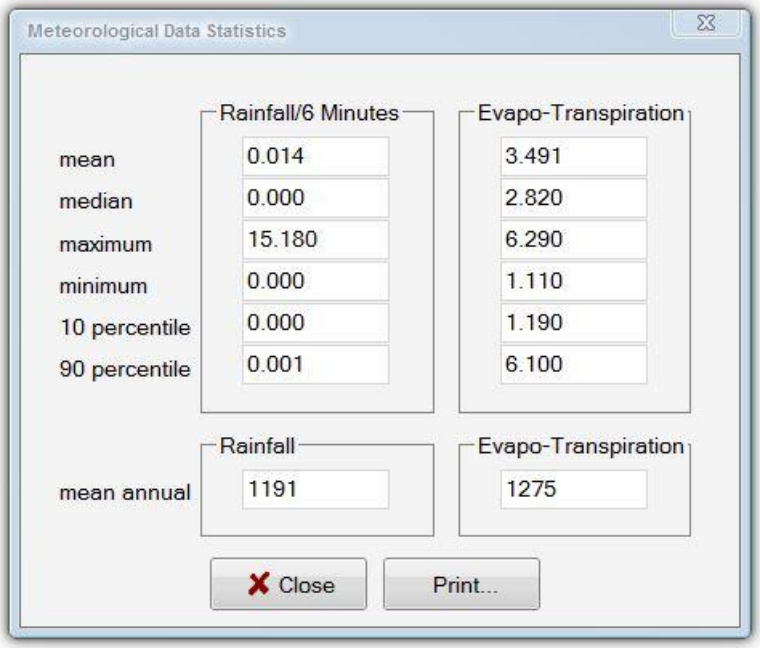
Statistics are produced in MUSIC for the following pollutants:

- TSS - Total Suspended Solids (kg/yr)
- TP - Total Phosphorus (kg/yr)
- TN - Total Nitrogen (kg/yr)
- Gross Pollutants (kg/yr)

6.2 Climate Calibration

Creation of a MUSIC catchment file requires an associated meteorological data file. SMCMA (2010) recommends using data obtained from the Bureau of Meteorology's pluviougraph rainfall station at Nowra for the period 1964 to 1970. However, that data has a mean annual rainfall value of just 874 mm and so is not ideal. Therefore, Nowra data from 1970 to 1975 is used, as it has a mean annual rainfall of 1,191 mm which is much closer to the site's. Basic rainfall and evapotranspiration statistics are in **Table 1** and the time-series graph is in **Figure 5**.

Table 1 - Rainfall and PET statistics adopted



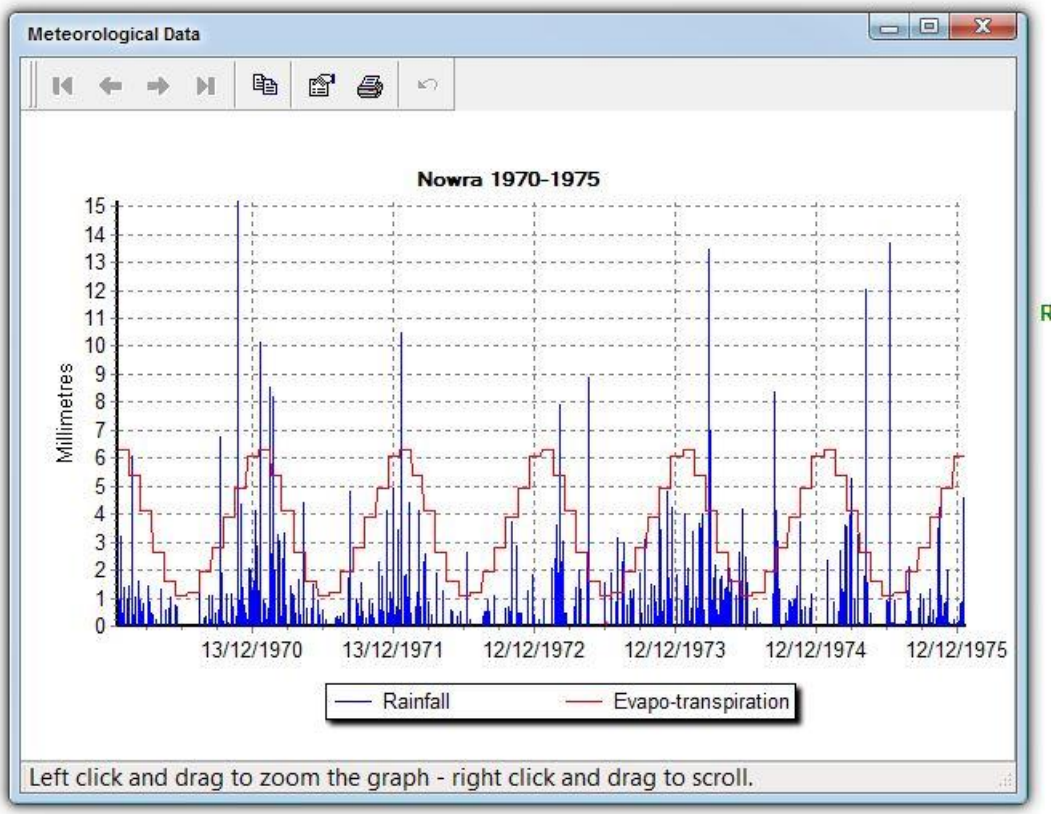


Figure 5 - Rainfall and PET Statistics

6.2.1 Node Calibration

Table 2 presents the storm flow concentration calibrations for the MUSIC model. They are the MUSIC default values.

Table 2 - Storm flow concentration calibrations used in MUSIC

	TSS mean (log mean)	TSS std dev (log std dev)	TP mean (log mean)	TP std dev (log std dev)	TN mean (log mean)	TN std dev (log std dev)
Rural residential land	89 (1.95)	2.1 (0.32)	0.22 (-0.66)	1.8 (0.25)	2 (0.3)	1.55 (0.19)
Sealed road	269 (2.43)	2.1 (0.32)	0.5 (-0.30)	1.8 (0.25)	2.19 (0.34)	1.55 (0.19)

The pervious area characteristics for both pre and post modelling are calibrated as in **Table 3**. They are those given in SCA (2012) for a clayey sand soil.

Table 3 - Pervious area calibrations used in MUSIC

Parameter	Value
Soil storage capacity	107
Initial storage	30
Field capacity	75
Infiltration capacity coefficient	250
Infiltration capacity exponent	1.3
Groundwater initial depth	30
Daily recharge rate	60
Daily base flow rate	45
Daily deep seepage rate	0

6.3 Pre Development Modelling Assumptions

The pre-development model is comprised of a single, undeveloped, rural residential node, 100% pervious and calibrated as in **Tables 2 and 3**.

6.4 Post Development Modelling Assumptions

The post-development model is comprised of the following source nodes:

- A rural residential node, 5.269 ha in area, set to 5% effective impervious and calibrated as in **Tables 2 and 3.** This area drains north to the proposed bioretention basin;
- A rural residential node, 1.87 ha in area, set to 5% effective impervious and calibrated as in **Tables 2 and 3.** This area drains south with no treatment; and
- A single, 2.16ha, road easement node, set to 30% pervious and calibrated as in **Tables 2 and 3**. This area drains north to the proposed bioretention basin.

Most of the lands drain to grassed swales on either side of the road and they drain to the single bioretention basin. The MUSIC model is shown diagrammatically in **Figure 6**.

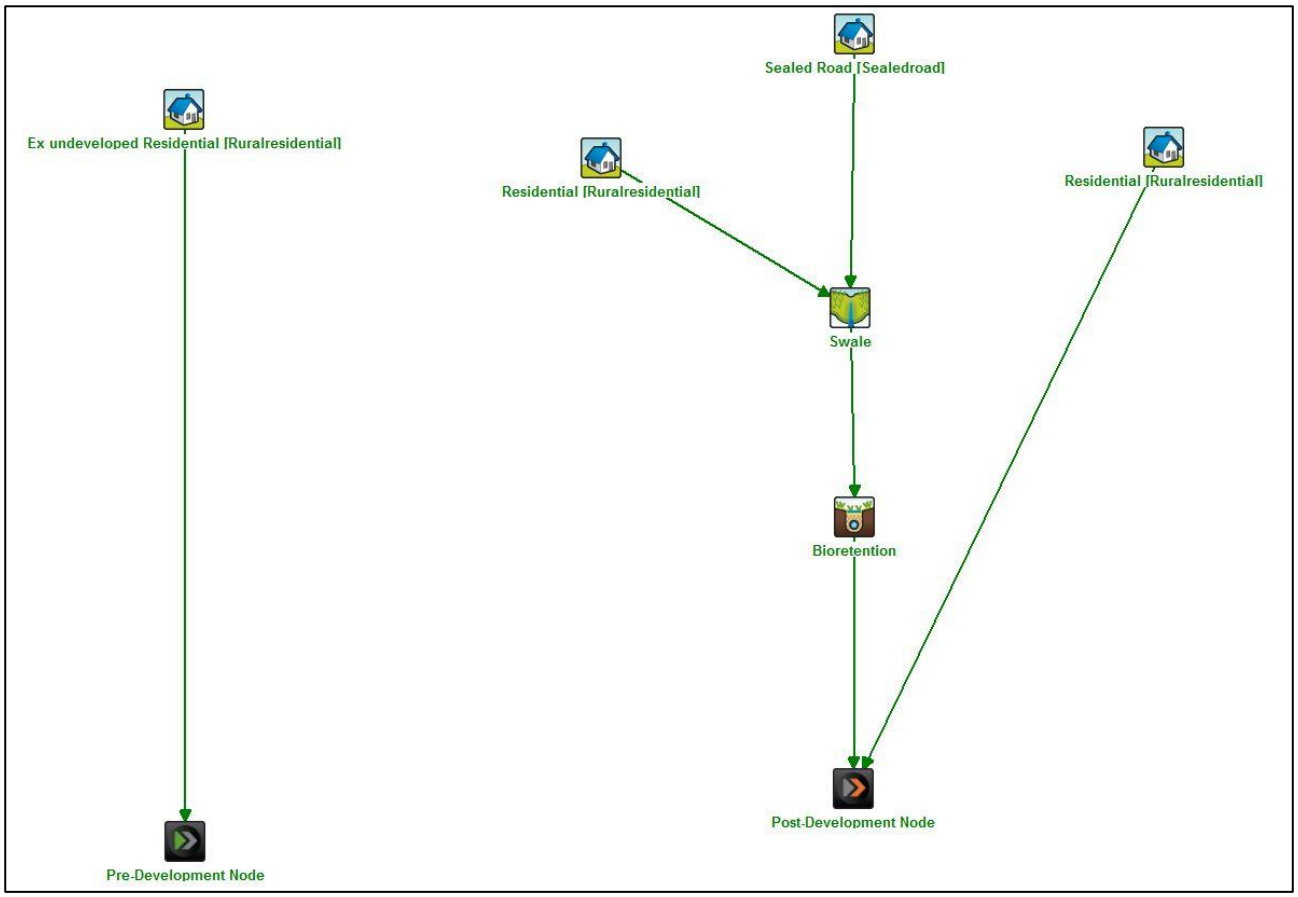


Figure 6 - MUSIC Model Schematic

6.5 Modelling Results

6.5.1 Mean Annual Loads

Table 4 contains the results of the modelling. It shows the proposed development would improve the existing mean annual load export of sediment and nutrients.

Table 4 - MUSIC Results: Mean annual loads [3]

	Inflow	
	Pre	Post
Flow (ML/yr)	38.2	43.4
Total Suspended Solids (kg/yr)	2.46E3	877
Total Phosphorus (kg/yr)	6.01	4.16
Total Nitrogen (kg/yr)	58.9	47.4
Gross Pollutants (kg/yr)	0.00	33.3

6.5.2 Pollutant Concentrations

To fully demonstrate a neutral or beneficial effect (NorBE), the post-development pollutant concentrations for phosphorous and nitrogen should be less than or equal to the pre-development concentrations for between 98 percent and 50 percent of the time (SCA, 2012). **Figures 7 and 8** show the concentration graphs for total phosphorous and total nitrogen respectively and show this condition can be met.

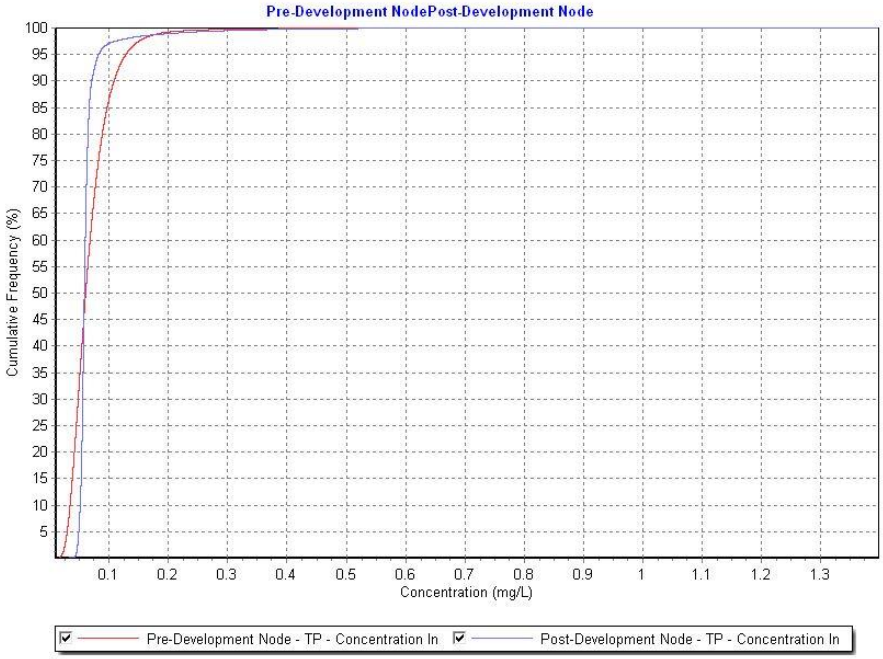


Figure 7 –Pre versus post for total phosphorous

[3] SEEC internal reference = 1970-1975 Run 2

Figure 8 –Pre versus post for total nitrogen

7 SUMMARY AND CONCLUSION

It is proposed to subdivide part of Lot 3 DP846470 that is zoned RU5 into 15 new large lots of between 0.4 ha and 0.88 ha (approx.). A loop road would encompass most of the development and would drain via grassed-line swales to a single bioretention basin. Proposed Lots 2, 3 and 4 in the far south of the site would drain offsite with no treatment.

The large size of each lot (no less than 4,000 m^2) means the effective imperviousness area on each would be low; estimated at 5%, SCA (2012). The new road would be 30% effective impervious.

The modelling shows a neutral or beneficial effect (NorBE) can be met.

The water quality measures (swales and bioretention basin) would be maintained by the body corporate that would enter into a contract with an appropriately-qualified contractor. The bioretention basin would have a defined life and would require replacement (or at least re-generation) every 15-20 years or so. Such work would also be the responsibility of the body corporate.

8 REFERENCES

SMCMA (2010). *Draft NSW MUSIC Modelling Guidelines.* Sydney Metropolitan Catchment Management Authority.

SCA (2012) - *Using MUSIC in Sydney's Drinking Water Catchment.* Sydney Catchment Authority, Penrith NSW.